Abstract No. Beet0315

Development of a Novel Apparatus for Experiments in Soft X-ray Diffraction Imaging and Diffraction Tomography

T. Beetz, C. Jacobsen, C.-C. Kao*, J. Kirz, T. Mentes, C. Sanchez-Hanke*, D. Sayre, D. Shapiro
Department of Physics and Astronomy, SUNY Stony Brook
*NSLS, Brookhaven National Laboratory
Beamline(s): X1A

Introduction: We report the development of a novel experimental chamber for experiments in soft x-ray diffraction tomography, diffraction imaging of single biological particles, and magnetic speckle imaging. The chamber will allow for acquisition of nearly full three dimensional diffraction data sets as well as high magnification zone plate images of holograms for the diffraction tomography experiment.

Methods and Materials: To minimize radiation damage, the sample is cooled to liquid nitrogen temperature using a Gatan 630 specimen holder, which provides us with a tilt range of ±80°. The sample holder is translated and rotated by a motorized 4 axis JEOL FasTEM goniometer system. This system together with the custom control software will allow us to automatically align the specimen after each rotation. Two in-vacuum xyz motorized translation stages with sub-micron precision are positioned close to the sample and hold zone plates, beam defining apertures and phosphor screens. They can be scanned for fast alignment using the custom control software. The detector, a completely in-vacuum backside illuminated CCD camera from Roper Scientific (1340x1300 with 20 micron pixels), can be translated parallel to the beam axis inside the chamber. Its position closest to the specimen, 10 cm, allows for recording high resolution diffraction data and its furthest position from the specimen, ~1 m, allows for high magnification zone plate imaging in diffraction tomography. Motorized in-vacuum stages in front of the CCD camera carry a photo diode and a beamstop to block out the direct x-ray beam. The whole experimental chamber is mounted on a moveable frame, equipped with precision actuators to allow for a fast alignment at different beamlines. The quality of the data and the ease and speed of data acquisition will be greatly enhanced with this new chamber.

Acknowledgements: This work is funded by the NSF under grant DBI-9986819, NIH under grant PHS 1R01 GM648460 and DOE under Contract No. DE-AC02-98CH10886.

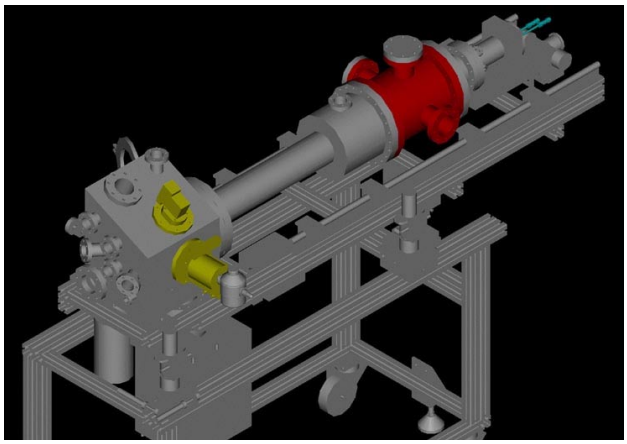

Figure 1: Layout of experimental chamber with JEOL goniometer.